

last mentioned were the Island of Waigatsch and Nova Zembla in the case of the first and Greenland and Newfoundland in that of the second\*.

In conclusion, the researches of M. Charles Rabot furnish us, in the first place, with new and precise evidence for zoological geography, and, secondly, enable us to assert that the fauna of the fresh waters of Iceland, in that which especially concerns the Entomostraca, presents mixed characters, recalling at once the analogous faunæ of Europe and, although in a less degree, of North America, in the temperate and arctic zones. The explanation of this fact is apparently to be looked for in the climatological conditions of Iceland, since it lies, as we know, almost at the point of contact of the warm and cold currents of the North Atlantic †.—*Comptes Rendus*, t. cxiv. no. 6 (February 8, 1892), pp. 310-313: from a separate impression communicated by the Authors.

*On a Sporozoon parasitic in the Muscles of Decapod Crustacea.*

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In 1888 one of us ‡ mentioned the existence of sporozoon parasites in the muscles of *Palæmon rectirostris* and *P. serratus*. The infected individuals are distinguishable at a glance by their opacity; they are of a chalky white, which contrasts with the normal transparency of these Crustacea. This opacity is due to the existence in the bundles of muscular fibrils of a considerable number of little granular masses. Each of these masses represents a little vesicle 10  $\mu$  in diameter, surrounded by a very delicate membrane and enclosing eight refringent corpuscles. The latter, which are slightly pyriform, measure from 3 to 4  $\mu$  in their greatest diameter. Their most swollen portion contains a clear vacuole, which occupies more than half of the corpuscle; the small extremity is constituted by a refringent substance. Owing to their aspect these corpuscles recall those of pebrine and the spores of certain Myxosporidia, such as those of the Gobies and the Stickleback. The fact that they are met with exclusively in the muscular fibres of the infected prawns had led us to assign these parasitic bodies to the Sarcosporidia, while at the same time regarding them as transitional between these on the one hand and the Microsporidia and Myxosporidia on the other.

Unfortunately all the specimens of *Palæmon* which we had examined exhibited the parasite at the limit of its evolution, in the

\* *Vide* J. de Guerne and J. Richard, "Sur la faune des eaux douces du Groënland" ('*Comptes Rendus*,' March 25, 1889), and "Revision des Calanides d'eau douce" (*Mém. Soc. Zool. de France*, vol. ii., 1889).

† Mohn, "Nordhavets Dybder, Temperatur og Strømminger" ('*Norske Nordhavs-Expedition*,' Christiania, 1887).

‡ Henneguy, "Note sur un parasite des muscles du *Palæmon rectirostris*," *Mémoires publiés par la Société philomathique à l'occasion du centenaire de sa fondation*, 1888.

sporiferous stage, and we had no idea as to its mode of development.

In 1891 Garbini\* found in the muscles of *Palæmonetes varians*, collected in the neighbourhood of Verona, a sporozoon very closely allied to that of *Palæmon rectirostris*; it appeared in the form of spindle-shaped vesicles enclosing eight pyriform spores. The author did not succeed in observing the first stages in the development of this parasite, which he regards as belonging to the Sarcosporidia.

At the same period one of us † mentioned the existence of parasites in the muscles of *Callionymus lyra* and of *Cottus scorpius*, and drew attention to the relations exhibited by these organisms with the parasite of *Palæmon* and that discovered by Gluge in the Stickleback, and for which he proposed the name *Glugea microspora*. By prosecuting the study of these sporozoa he has been able to determine the existence in the spores of *Glugea* of a capsule with a spiral filament ‡, an element which, as we know, is characteristic of the Myxosporidia. He has since succeeded in making the same observation with regard to the spores of the parasite of the muscles of *Cottus*.

It was therefore to be presumed that the parasite of the muscles of *Palæmon* likewise exhibited this character, and should also be assigned to the Myxosporidia.

An observation has quite recently been made which confirms this hypothesis and enables us to study the development of the spores.

Through the courtesy of Prof. Giard we have been able to examine a specimen of *Crangon vulgaris* from Boulogne, which exhibited the chalky appearance already mentioned in connexion with the infected prawns. On making a microscopical examination we found all the muscles invaded by a parasite identical in aspect with that of *Palæmon*, from which it differs only in being of larger dimensions, the spores measuring from 5 to 6  $\mu$  instead of from 3 to 4  $\mu$ .

In this case also the spores are arranged in groups of eight in vesicles with very delicate walls. They are pyriform and possess an envelope which resists potash, and their large extremity is occupied by a clear vacuole, as in the spores of the parasite of *Palæmon*, *Cottus*, &c.

By treating them with hydrochloric or nitric acid we have been able to determine the issue of a filament at the level of the small extremity. It is nevertheless very difficult to produce the emission of this filament, and we have only observed it a very few times in spite of repeated efforts in this direction.

In addition to the vesicles containing eight spores, which repre-

\* Garbini, "Contributo alla conoscenza dei Sarcosporidi," *Reddiconti della R. Accad. dei Lincei*, vol. vii., February 1891.

† Thélohan, "Sur deux Sporozoaires nouveaux, parasites des muscles des Poissons," *Comptes Rendus de l'Académie des Sciences*, January 1891.

‡ Thélohan, "Note sur la *Glugea microspora*," *Comptes Rendus de la Société de Biologie*, January 30, 1892.

sent the ultimate limit of the evolution of the parasite, we have met with a whole series of younger stages, which has enabled us to follow the development of the spores, and thus to fill up the gap which existed in the history of the parasite of *Palæmon*.

Here, in fact, by the side of ripe spores we have observed little spheres of plasma, provided with a nucleus. These little elements are surrounded by a delicate envelope of a hyaline substance which resists the action of potash. They measure about  $12\ \mu$  to  $14\ \mu$  in diameter.

We soon observe that the nucleus loses its membrane and assumes the arrangement known as the chromatin wreath ("peloton chromatique"). We next witness the formation of an equatorial plate, then its division into two, and so on.

It is therefore seen that we are dealing with a case of fission by karyokinesis. We did not succeed in obtaining a clear view of the achromatin fibres, probably in consequence of the small dimensions of the elements. The indirect division of the nucleus in the Myxosporidia has, moreover, already been described by one of us\*.

After the division of the nucleus the plasma soon divides in its turn, and we observe within the envelope two little nucleated masses. The same phenomena of fission are repeated, and by means of successive bipartitions we finally get within the envelope eight little nucleated masses, at the expense of each of which a spore will be formed. It is impossible to follow the formation of the latter in detail in consequence of its small dimensions.

To recapitulate our results. The organism which we have observed in *Crangon* must be assigned to the Myxosporidia, since its spores enclose an eversible filament.

It is interesting on account of its habitat, for Myxosporidia had not hitherto been stated to occur in Arthropods, except in *Tortrix viridana* by Prof. Balbiani.

This parasite is very closely allied to *Glugea* and to the parasites of *Cottus* and *Callionymus*; it differs from them by the constant number (eight) of spores which develop in each ripe vesicle.

It has enabled us to confirm the observations made by one of us with regard to karyokinesis in the Myxosporidia.

Lastly, it is so intimately related to the parasite of *Palæmon* that we may, we believe, extend to the latter the results of our observations.—*Comptes Rendus hebdomadaires des séances de la Société de Biologie* (Séance du 25 juin, 1892): from a separate impression, communicated by the Authors.

\* Thélohan, "Recherches sur le développement des spores chez les Myxosporidies," *Comptes Rendus de l'Académie des Sciences*, November 1890 (*Ann. & Mag. Nat. Hist.*, March 1891, pp. 304-306).